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ject by means of a mirror. She had no fear of the camera, however, and once returned to the nest while my head was under the focusing cloth.

In no case have I seen a male hummingbird in the vicinity of the nest or in any way showing interest in the matter. In fact, all the males had apparently started on their southward migration by the middle of June, 1922, or soon after the eggs had been laid in the last nest and while the young in the second nest were no more than half grown. None was seen earlier than May, probably on account of the lateness of the season, so their stay was very short this year. By July 1 the females and young were also noticeably scarcer. If the owner of the third nest had remained to hatch out and rear her young she would probably have been detained beyond the usual time for migrating.

Despite the small size of the hummingbirds, and of the Costa in particular, the eggs and young as well as the adults must be peculiarly immune to depredations of natural enemies, as evidenced by their survival in the face of several unfavorable conditions brought out in the foregoing notes and which may be enumerated as follows: First, only two eggs are laid and presumably only one brood raised each year by the Costa Hummingbird; second, the period during which the young are confined to the nest is from 50 percent to 100 percent greater than in the case of the smaller passerine species; third, the young are entirely dependent upon the female parent for sustenance. That the hummingbirds are able to maintain their numbers under these handicaps can but increase our admiration for these tiny but highly specialized and intelligent creatures.

Los Angeles, California, August 21, 1922.

EVIDENCE OF MUSICAL "TASTE" IN THE BROWN TOWHEE

By RICHARD HUNT

TO BEGIN WITH I wish to establish in the minds of those readers who do not happen to be familiar with the Brown Towhee (*Pipilo crissalis crissalis*) a working idea of this bird's song. The song is normally a staccato series of sharp metallic clinks with intervals constantly decreasing so as to carry the utterance into a thrill or vibration toward the end. The "shape" can be easily imagined by thinking of some resilient object, say a golf ball, dropped on a hard surface and allowed to bounce itself motionless, thus: *tip—tip—tip—ip-prrrrr*. A very good idea of the timbre can be gained by striking together two silver dollars so as to produce a smart and rather "live" ring.

Except in two instances, which I am about to describe, I never was struck by any signs of instability in the Brown Towhee's song. On the contrary I had come to consider the song so stereotyped that it would be absurd to expect any marked individual divergences. "Brownie" had become in my mind a dull fellow, musically, particularly devoid of originality. It was refreshing, therefore, to hear first one and then another individual of the species sing a song that was decidedly "off color"—not, mind you, in any trivial matter of mechanics due to inexperience or adventitious defect of execution, but in what I may call subject matter. Both of these "aberrant" singers that by good fortune came to my notice departed from the type utterance of their race by *adding* some brand

new notes at the end of the common song; and these brand new notes were unmistakably imitated from other species.

I heard the first of these two abnormal songs near Chalk Peak, in the Santa Lucia Mountains, Monterey County, California, June 22, 1919. Over and over again the bird sang the typical "bouncing" song of the species, *plus* a low bubbling warble of four syllables. The warble was so nearly identical with part of the song of the Western House Wren (*Troglodytes aedon parkmani*) as to be, in itself,mistakable for it. The song ran: *tip—tip—tip-ip-prrrrr, chreh-chreh-chreh-chreh.* This song struck me at the time as a "freak", but I made a careful record of it, nevertheless, and on my return home filed the record away.

This "freak" song was given new meaning when, three years later, namely, on May 2, 1922, I heard, in the Botanical Gardens of the University of California, the following: *tip—tip—tip-ip-prrrrr, chrip-chrip.* The added feature this time was a perfectly good chirp of the Linnet (*Carpodacus mexicanus frontalis*). The towhee sang this song repeatedly with no deviation except that occasionally it used a single instead of a double chirp.

The thing that seems to me significant about this business is that these two "off" songs, coming by chance to my attention, and occurring quite independently of each other in point of space and time, should be so remarkably alike in their "offness". I can hardly escape the belief that the observed facts indicate a racial, rather than an individual tendency at work. Chauncey J. Hawkins, discussing the evolution of bird song (1922, p. 53) asserts that "when we turn from the study of individuals to the group of individuals which has assumed the rank of subspecies then divergences are perpetuated." He mentions some typical evolved differences of utterance between subspecies. The theory is that they exist as fixed differences now, because the original tendency to departure from the type was uniformly expressed by the individuals of a *group*. The freak or exceptional songs "are not perpetuated in the life of the species nor in subspecies. They are lost with the individuals." I am proceeding on the not too unreasonable assumption that my two aberrant Brown Towhees represent a "group." It seems not improbable that, since two individuals with similarly divergent songs have come to my personal attention, there must be others which have not. I base my assumption on the fact that the two songs are alike, not in one respect (which might be accidental) but in several respects, which I shall mention presently. This points to something deeper and more lasting than individual eccentricity.

We know that a Brown Towhee hatched say in Humboldt County behaves, looks, and *is* "like" another Brown Towhee hatched in Monterey County. It is three hundred miles from Cuddeback to Jolon, but the Brown Towhees of each locality are more nearly alike than any two randomly chosen humans of the same race. Why? Because both individuals—though they, nor their parents, never have come in contact—partake of the specific essence of *Pipilo crissalis crissalis*. Nothing has gone from one to the other, or even from any ancestral *Pipilo* to them. Yet they are what the ancestral *Pipilo* is, in size, shape, color, mannerisms, voice. And, since they are alike in these essentials why should they differ in the essential of song-improvement? "Germ-cells", says Charles Otis Whitman (1919, p. 179), "behave alike in development, not because anything is transmitted to them, but because they represent *identical material and constitu-*

tion, and are exposed to essentially like environmental conditions." Is not the manner of song modification as much "identical material" of the Brown Towhee as is his brown coat or his mincing step as he forages in the grass? Is it not as natural that two individuals of a species should behave alike in improving as in possessing a song? The facts impressing me as significant because of their appearance in both of our towhee songs, are as follows:

1. The fact of elaboration.
2. The fact of elaboration through imitation.
3. The fact of elaboration through adding the imitated syllables at the end.
4. The fact of the comparative musical quality of the imitated syllables (as contrasted with the hard metallic quality of the notes in the "bouncing" song).

Certain ideas, of not too speculative a character, I hope, to be of some value, occur to me in connection with each of these four points.

1. *The fact of elaboration.*—It would seem that all birds who possess songs possess a tendency to elaborate or improve their songs; that is, to render more perfect their songs in the number, kind, and arrangement of notes. The finest singers among birds (so considered from the human point of view, and so too in actuality, I believe) are the producers of comparatively prolonged and complex musical effects. The evolution of bird song evidently proceeds from simplicity to complexity.

The simplest songs are those sung in short set form—running automatically in pre-established grooves. Within this definition, the simplest are those containing only one kind of sound. Finally, these two essentials being complied with, the simplest are those in which the one kind of sound involved is derived from the call- or alarm-note of the singer. Charles A. Witchell describes (1896, pp. 49-50) the songs of some fifteen birds, and remarks (p. 53), "In all the above-mentioned British species, and in some of their allies, which represent many avian races, the males court the females partly by the repetition of notes which we observe to be employed in other circumstances as call-notes; and in some species these notes are repeated so rapidly that a phrase is constructed. But some species have never advanced beyond the mere repetition of their call-notes." He expresses the belief (p. 58) that "songs were, at first, mere repetitions of call-notes, or possibly of defiance-cries, which have since been more rapidly uttered and varied, with the result that novel strains have been slowly developed." Among American birds two species occur to me off-hand as possessing songs more or less of this type. One is the Linnet, whose zig-zag, twittery warble is found on analysis to be composed partly of the call-note, or chirp, of the species. The other is the object of our present study, the Brown Towhee, whose normal song is composed wholly of repetitions of its alarm-note.

The typical "bouncing" song of the Brown Towhee, though according to our definition very simple, is doubtless even at that an elaboration of something still more simple, which in turn we must trace back through imperceptible stages to its humble origin, the alarm-note. The alarm-note (in the Brown Towhee as in other song-birds) must have existed before the song. Without bothering ourselves here about the origin of alarm- and call-notes (whether to be found in spasmodic muscular contractions acting upon the trachea in moments of excitement or of effort, or to some necessity of emotional expression for purposes of social control [see Wallace Craig, 1908]) we can feel pretty sure that the song is the most advanced form of expression in the bird's vocal his-

tory. It is elaborated from pre-existing elements, and is in no wise conceivable as in itself an original form of utterance.

The above considerations cannot pass through the mind without bringing in their wake the question: Is there any useful purpose served in this fact of song elaboration? Does it get the bird anything it lacked before? Is an essentially songless bird a loser in the give and take of avian existence?

Witchell makes certain observations (p. 177) suggesting the possibility that in the strict social economy of bird life the elaborating tendency may be somewhat counteracted by some necessity of preserving the specific identity of both calls and songs for reasons of practical convenience. The calls certainly, and the songs almost as certainly, might lose their usefulness in a social sense if modified at the whims of individuals. But evidently individual modifications are not passed on and therefore do not become of racial importance. The slowness of organic evolution makes it plain that there must be deep-seated in birds, as in the rest of nature, an instinctive obedience to some principle of conservative action.

But just as plainly there is an instinctive recognition of the necessity of progress. That must explain why individuals get "freakish". But their freakishness avails the race nothing unless they get that way in groups, following a *racial* behavior pattern. It is a truism to say that life—including vocal bird life—implies within itself the need for growth, advancement. But even that does not satisfactorily explain why a bird improves its song: it merely says that he does because he does. Now, the following, I admit, is a theory. Given the primal necessity for song improvement, existing merely because the bird is *alive*, I believe that it carries with it and confers upon the bird, as a result of itself, some appreciation of itself. The bird, in other words, somewhat *appreciates* the work which it finds itself to have done in the line of song improvement. It is not unaware of its achievement, and is "interested" or "pleased" or even "elated". On what grounds? Because it feels the results to be useful or practical? I doubt it. Because it feels them to be pleasing—that's all. Insofar as vocal bird life is concerned, I cannot help believing that we are concerned with what Lloyd Morgan has called (p. 270) "the germs of aesthetics". In his lowly way—on his "perceptual" rather than "ideational" plane of mental development—why should not a bird, in his leisure moments and under the spell of the mating season, feel an impulse to outdo himself in song—an impulse heightened by his realization of results spontaneously achieved by mere virtue of living? I believe that herein lies the explanation of the evolution of bird song. The songster is an esthete. I shall say more of this beyond.

2. *The fact of elaboration through imitation.*—Upon analysis of the situation it becomes apparent that bird song can be elaborated in no other way than through imitation. The "mimetic origin of bird song" (see Rhoads, 1889) is not only the reasonable, but the inevitable origin—only we must here guard against understanding "origin" to be a synonym of "cause". Mimicry is certainly not the cause of song-development: it is the *method* employed—the only method, in the nature of things, available. Elaboration is imitation; though in many cases songs that we consider "original" may have been in reality copied from singers that have ceased to exist in the age and environment of the imitator (see Witchell, p. 227). It is, after all, quite natural that a species, working out its song through its individuals, should seize upon and utilize the notes of

other species. Where would the bird find material for its song if not through *hearing* it? New phrases in the human language are made up of old words, and the same thing holds in bird song. It would be impossible for a bird to "invent" or "originate" a song. But all of this is too obvious to require discussion. The elements of bird song must have pre-existed; they must have been first heard and then reproduced. In their ultimate analysis they must have been physical, derived from insensate sources and inanimate features of earth and the elements, or the involuntary and accidental movements of primitive voiceless things, animal or vegetable. But all of this is "another story" for which see Witchell (pp. 181-186). Coming back to what Witchell calls (p. 177) "that imitative tendency which is latent if not evident, in nearly every bird with any pretensions to a song"—let us ask again: What does song imitation (or elaboration) mean (if anything) in the social economy of bird life?

If the bird is in no wise responsible for anything that he does but is sustained in all acts by an ultimate cause, then it is perhaps vain to look for the meaning in his behavior. But if we conceive that the bird displays some consciousness of its own behavior, some intelligence of its own (even though it be a mere image of the greater intelligence, an effect worshipfully endeavoring to ape its cause) then we can at least observe the behavior of this "image" and come to some conclusion as to what *it* is trying to do and why. If we form some estimate of the bird's apparent intelligence, as we see it at work, we may gain a hint as to the true purpose that is being expressed or reflected therein.

To take an example of imitation in its most striking manifestation, let us turn for a few moments from the Brown Towhee to the Mockingbird. This bird, according to Lloyd Morgan (p. 193) represents a stage of "intelligent imitation, arising in close connection with interest in the doings of others . . .". The three stages (as illustrated by the human child) are, "First, the instinctive stage, where the sound which falls upon the ear is a stimulus to the motor-mechanism of sound production. Secondly, the intelligent stage of the profiting by chance experience. . . . If we assume that the resemblance of the sounds he utters to the sounds he hears is itself a source of pleasurable satisfaction (and this certainly seems to be the case), intelligence, without the aid of any higher faculty, will secure accommodation and render imitation more and more perfect. And this appears to be the stage reached by the mockingbird or parrot. But the child soon goes farther. He reflects upon the results he has reached . . .". Professor Morgan adds that "of intentional and reflective imitation there is at present no satisfactory evidence in any animal below man".

Let us examine a typical song of the Mockingbird (*Mimus polyglottos leu-copterus*), one recorded by me in the San Joaquin Valley, near Mendota, Fresno County, California, June 20, 1918. During a period of listening I recorded eleven "original" or un-imitated and nine imitated parts. The imitated parts, rendered in a manner that ranged from fair to perfect, were unmistakably referable to the following birds: Traill Flycatcher, English Sparrow, Western Belted Kingfisher, Ash-throated Flycatcher, Sparrow Hawk, California Cuckoo, California Shrike, Red-shafted Flicker, and Killdeer—all, by the way, birds present in the habitat of this individual Mocker. In addition to these notes the bird uttered several others which suggested the notes of other species without being quite enough like them to be fairly called imitations.

Whenever I hear a Mockingbird sing I cannot help wondering just where, if anywhere, the line can be drawn between the second and the third stage de-

scribed by Professor Morgan. In taking a "pleasurable satisfaction" in "the resemblance of the sounds he utters to the sounds he hears" is not something akin to reflection on the results necessary? Moreover, are the performances of the Mockingbird and the Parrot analogous? I do not believe they are. The mimicry of the Parrot is certainly associated with different instincts and emotional conditions than is that of the Mockingbird; for the Mockingbird—the *male* Mockingbird, let it be pointed out—is uttering his *song*, which, as is commonly agreed, is an emotional expression intimately connected with the sexual instinct, whereas, unless I am much mistaken, the "talking" of the Parrot rests on no such basis and bears no relation to sex feelings, but is more akin to mimicry as an instinct in itself such as we perceive in the actions and gestures of monkeys.

The Parrot undoubtedly does not rise above the second or "intelligent" stage, if indeed he attains it at all. He is *forced* to imitate, he is *taught* to imitate; he is removed from his natural environment, confined in a cage, and worked upon by designing minds that happen to know that his trachea is naturally suited to the production of human-like sounds. The Mockingbird on the other hand carries on his mimicry in the wild state. He needs no urging—sex is his urge—and, unless his behavior is very misleading, he not only takes a "pleasurable satisfaction" in the results of his vocal efforts, but he does so because he *dwells upon* those results with pardonable appreciation. After having, on so many occasions, noted the characteristic manner in which the Mockingbird "plays with" imitated sounds, rolling them about on his tongue one might say, as with the greatest gusto, trying them over and over, sometimes with little variations in inflection and intensity, seeming to be constantly experimenting with his material—I, for one, cannot avoid thinking that his mental state is characterized by a sort of reflectiveness.

I do not believe, however, that any practical considerations mark the bird's reflectiveness. I do not believe that the social economy of his life in any way determines or is determined by the results achieved. I believe that the bird's interest in his own mimicry is "artistic"—and the social economy can take care of itself as best it can. My reasons for holding the above beliefs are as follows.

The Mockingbird, as typically shown in the above described song, imitates a comparatively large number of birds, and he imitates them with sufficient skill to deceive them, provided they are susceptible to that sort of deception. Of the imitated birds concerned in our particular record, five are permanent residents and four are summer residents in the habitat of the imitator. In the summer they are all more or less prominent "citizens" of that part of the Lower Sonoran Zone where our Mocker is found. And our Mocker, without any too fine discrimination or apparent regard for the "feelings" of his neighbors, mimics them right and left, appropriating any and all sounds that are persistent enough to impress him at all. The affair is of social significance in that the whole community is involved. The Mockingbird drags all his most prominent neighbors into the performance and holds them up to mimicry. Are his neighbors aware of this fact? If so, does it make any difference to them, and how, if at all, do they re-act? And the mimic himself—what does he derive from the performance? Does he gain therefrom anything in a practical way for himself and for his species, especially for his mate? Or, on the contrary, does he cause himself and his kind only trouble and confusion?

So far as appearances go this incorrigible mimic is easily holding his own in "the struggle for existence." If his mimicry causes confusion among any of the species mimicked it apparently does not come back on him or his race. His mimicry, so far as I, myself, have ever observed, or read, or heard, does not cause confusion among his own kind. But I doubt if he *gains* anything beyond a certain "aesthetic pleasure"—an emotion doubtless shared with his mate, but not otherwise having any "social" significance.

It might be claimed, of course, that the Mockingbird "gets away with" his promiscuous mockery solely because of his pugnacious disposition and ability to take care of himself, whereas a less able bird, say a Goldfinch, might court death if it had the temerity to imitate a Sparrow Hawk or a Shrike. Personally, however, I cannot easily picture a Goldfinch* (assuming it to be an imitative bird) meeting its death as the result of mocking a Shrike. The Shrike is not a gregarious bird, and the only call it might conceivably respond to (that is, fly towards) would be the sex-call of its kind. It would then respond in a wooing, not in a killing, mood.

Let me concede the possibility, however, that it might, on discovering its mistake, change its mood, and kill the Goldfinch. Such events would tend to eliminate from the racial song of the Goldfinch any and all notes copied from birds that prey on the Goldfinch, since, in each case, the individual doing the imitating would perish. But even though this may be the case with some birds, it does not seem to be with the Mockingbird, whom we may observe imitating "dangerous" birds with apparent impunity.

It seems to me utterly absurd that a Shrike should "imitate other birds for the purpose of attracting them within range of its attack"—a habit that Yarrell, as quoted by Witchell (pp. 173-174), attributes to the Great Grey Shrike. It very well may be that the Great Grey Shrike has imitative powers; and undoubtedly this bird is capable, in certain ways, of profiting by chance experience. But I cannot picture this as one of the ways: it is endowing the bird with too much intelligence.

I do not believe, then, that practical or economical considerations enter into the choice of sounds to be imitated by the Mockingbird or by any bird. The behavior of imitating birds does not indicate such to be the case.

There are two main factors, however, that I believe to be reasonably borne out by observable facts, influencing the choice of sounds to be imitated. In discussing these factors, let us return to the Brown Towhee as being a bird in the simpler and early stages of song evolution and as furnishing therefore a less complex "test case" for our purposes than the Mocker. To make our case definite let us keep in mind as our individual example the Brown Towhee of the Chalk Peak region of the Santa Lucias who imitated the Western House Wren. Let us make a note of the fact that he belongs to a non-migratory race. The association where I found him was arid Transition in the yellow pine belt. It is assumed that a bird is most influenced by the sounds of its environment during its own song period, that is, during the spring and summer months. With these ideas in mind, it can be demonstrated, I believe, that the number of bird-notes available for imitation in the habitat of our Brown Towhee is far more limited

*Since there are no American birds besides the Mockingbird in the evolved stage of mimicry, I am forced to choose as my example a non-imitative bird. In contrast to the dearth of mimics in this country see Witchell's enumeration of imitative British birds (pp. 190-229).

than one would probably assume off-hand. The factors influencing his choice of notes are as follows:

- (1) Persistency of the sounds in the imitator's environment. Such persistency determined by:
 - (a) Seasonal status of "subjects" of imitation. All transients and irregulars would be eliminated since their notes would not persist in the imitator's environment for a sufficient number of weeks nor would they persist during the imitator's impressionable period.
 - (b) Associational preferences of subjects. Those of extremely local or restricted range would be eliminated. This counts out the Bell Sparrow (which I found only on the sagey west slope of Chalk Peak); the Western Bluebird, the Pine Siskin and the Linnet (which showed a decided preference for the west slopes down toward the Redwoods); and the Violet-green Swallow and Martin (whose aerial habits kept them a good part of the time out of hearing of our imitator).
 - (c) Numerical distribution of subjects. Those of rare or occasional occurrence would be eliminated, namely, the Slender-billed Nuthatch, the Cabanis Wood-pecker, the Nuttall Woodpecker, Western Kingbird, the California Thrasher, the Cassin Vireo, the Lawrence Goldfinch, the Black-throated Gray Warbler, the Western Gnatcatcher, the Point Pinos Junco, Mountain Quail, the Tawny Creeper, Mourning Dove, Audubon Warbler.
 - (d) Time of activity of the subjects during the twenty-four hours. Birds of nocturnal or crepuscular habits would be eliminated, namely, the Poor-will and any owls that might inhabit the region.
 - (e) General vocal strength of subjects. The following weak-voiced birds are eliminated: Creeper, Pygmy Nuthatch, Bush-tit, Bluebird, Siskin, Anna Hummingbird, Allen Hummingbird, Western Gnatcatcher.
 - (f) General vociferousness of subjects. The Buzzard is eliminated as being silent.
 - (g) Uniformity of utterance on the part of the subject. The Plain Titmouse is too versatile; does not stick long to any one note. The Thrasher, Black-headed Grosbeak and Purple Finch (whose persistent utterances are their songs) sing in a manner too long, "diffuse" and variable to allow any one sound to outstand.
- (2) Physiological conditions connected with the peculiar nature of the syrinx and other vocal apparatus of the imitator. Obviously certain types of sound could not be managed by the comparatively unelastic and unpracticed syringeal membrane of the Brown Towhee. Thus at least two classes of sound would be physiologically unmanageable:
 - (a) Too voluminous sounds, such as those of the California Quail, Band-tailed Pigeon, and California and Crested Jays (heavy *chup-chup-chup* notes of each, and the common *zhrae* of the former).
 - (b) Too low sounds, such as those of the Mourning Dove and Band-tailed Pigeon.

Applying the above tests to all of the birds recorded by me during my stay in the Santa Lucia Mountains, I find that I have eliminated all but nine. These nine represent birds which have one or two utterances to be heard persistently all day long every day during the summer months. Following is a list of the birds and their notes:

California Woodpecker	"yarcob" and "cracker"
Red-shafted Flicker	"klee-yuh"
Ash-throated Flycatcher	"kippy" and "kip-preer"
Olive-sided Flycatcher	"peevue" and "puip-puip-puip"
Western Wood Pewee	"beeeezzzz"
Spurred Towhee	"thwaaaa" and song
Western Tanager	song
Western House Wren	song
Wren-tit	common "tattoo" call

These are thirteen sounds forcing themselves incessantly upon the Brown Towhee's attention. It is reasonable to assume, then, that they are the sounds most in line for imitation. The question is: *Why is the House Wren's song the sound chosen?*

"One of the most extraordinary facts of our life," declares William James (p. 217), "is that, although we are besieged at every moment by impressions from our whole sensory surface, we notice so very small a part of them. The sum total of our impressions never enters into our *experience*, consciously so called, which runs through the sum total like a tiny rill through a broad flowery mead. Yet the physical impressions which do not count are *there* as much as those that do, and affect our sense organs just as energetically. Why they fail to pierce the mind is a mystery . . .".

This was written concerning human experience, but I do not see why it is not just as applicable to bird experience. The factor of *attention* certainly enters into the situation. The Towhee "just naturally" attends to certain sounds and disregards others. As between a dozen sounds equally thrust upon his ears, he is for some reason *interested* in certain ones more than others, and therefore all the others are shut out of his conscious consideration.

To quote from Lloyd Morgan: "We often say . . . that *interest* guides behavior in this direction or in that. But such interest must not be regarded as an impelling force; it is an attribute of the conscious situation, more or less suffused with feeling-tone. It is not easy to define; but it seems to take on its distinctive character when representative elements contribute what Dr. Stout terms 'meaning' to the conscious situation".

When a Brown Towhee (acting for and in accordance with its race, due to the identity of germ-plasm in all members) selects the song of a House Wren rather than any one of the other eleven sounds equally forced upon its sense of hearing, the song of the House Wren must have some special *meaning* over and above the other sounds. Let me ask even again: Has this meaning anything to do with the social economy of Brown Towhee life? Is it a matter of life and death that certain types of sound shall be shut out of the conscious attention, and others heeded? And again let me reply that I do not believe any such thing. When it is becoming so questionable that even a human being is born with anything within him that causes him to act for the advantage of his own kind, why should we expect it in birds? Human beings show "interests" in things, but these interests are commonly in no way connected with race progress and are not even vital to the individual. I mean, it makes no killing difference if a wavering boy finally chooses radio operating instead of architecture. Nor does it make any more difference whether a Brown Towhee chooses to imitate a Wren song or a Flicker call. Insofar as a choice of musical sounds is concerned it does not seem reasonable that anything is at work except a sort of *taste*. Human beings like and pay attention to certain musical compositions above certain others. So does the Brown Towhee. In selecting the song of the House Wren he is guided, in my opinion, by a lowly sort of aesthetic feeling. Xenos Clark believes that birds have "an ear for music" and that in evolving their songs they follow a harmonic pathway, which, however, happens to be for them the pathway of least resistance. The primitive bird, he says (p. 212), "sang to please himself or his mate, and the most pleasing combination of notes was that most easily heard; the combination producing least friction and securing the

most economical action of the sound-receiving apparatus". This places the matter on a purely mechanical and automatic basis, although the *results* are what we may call aesthetic. The results, I believe, are not unappreciated by the singer, and he re-acts with a more conscious exercise of "artistic taste". I believe, in short, that the actual *superior musical quality* of the House Wren's song, consciously appreciated by the Brown Towhee, is the final factor in the selection of *it* instead of the harsh "cracker" of the California Woodpecker, the yelping "klee-yuh" of the Flicker, and other more or less unmusical sounds in the list. But for further discussion of this theory I refer my reader to the final section of this paper. And now let me pass to the next division in order, namely:

3. *The fact of elaboration through adding the imitated syllables at the end.*—An analysis of the two Brown Towhee songs which are the subject of this paper reveals that they are the stereotyped song of the species *plus* some acquired syllables. The acquired syllables in each case occur *at the end* of the stereotyped song. Now, this manner of elaboration is, it seems to me, the easiest and most natural one—the one which a bird taking its first clumsy steps in the direction of song improvement would of necessity employ. Even human beings are inclined to have "single-track" minds that cannot easily accommodate two thought-trains abreast. They wish to do "one thing at a time"; otherwise they are apt to become flustered and end by doing neither of the two things intended. It seems perfectly natural that the Brown Towhee should sing the old familiar song *first*, and then give his undivided attention to innovating. Reverse this technique and we immediately picture the bird so flustered at his attempt to *plunge directly into a radically different type of utterance* that he would not be able immediately to pass on to the regular syllables. The accustomed song is the momentum, the encouragement, that carries him into the less familiar performance.

Witchell (p. 192) quotes Bechstein to the effect that the (European) Redstart "can improve its song . . . by adding to it parts of the songs of birds that are found near it". He vouches for the fact that Bechstein "accurately records that the Redstart *adds* the notes of other birds, for the imitations of this species are uttered at the end of the ordinary strain, to which they form a kind of *sotto voce* suffix".

The Redstart, then—even though mimicking a goodly number of other birds (Witchell, p. 218)—nevertheless *adds* the mimicked notes amateurishly (as I may call it) at the end, even as does the Brown Towhee. Both Redstart and Towhee, it would seem, are in the *practice stage* of mimicry, as opposed to the more advanced stage attained by the Mockingbird who interpolates imitated passages at will with all the assurance and independence of a human improviser. In England, it would seem, there are a number of such accomplished and evolved mimics, including the Thrush, the Robin, the Skylark, the Starling, the Sedge-Warbler, and the Nightingale (Witchell, pp. 194-219). In fact, one gathers the impression that mimicry is quite the thing in the best English song-bird circles!

4. *The fact of the comparative musical quality of the imitated syllables.*—The fact that the imitated portions in *both* of our two "off" Towhee songs, though borrowed from two different birds, nevertheless both contained a liquid *r*-sound and a vowel-sound of decidedly lower pitch than the piercing, high-frequency *i*-sound emanating from the traditional *tip!* of the species, suggests the idea that, other things being equal, the Brown Towhee is *interested in* sounds of a more fluent and of a softer nature than those used in his ordinary song.

Let us also here note, as of possible significance, the fact that the only *other* utterances possessed by the Brown Towhee besides his "bouncing" song are: (1) A succession of eight or nine rather distressed-sounding squeaking sounds, somewhat as one might squeak with one's lips, and (2) a faint high attenuation of what we may call the *family "tseep"* of the Fringillidae, some version of which is found in most of the sparrows. Neither of these two "other utterances" are in the least musical. Is it, then, endowing our bird with too much "aesthetic" sense to presume that through the ages he has been listening with something akin to admiration to sounds that were more musical than his own? Some people may object that sounds which are considered "more musical" by the cultivated human sense would not necessarily be so to the senses of lower animals. I do not agree with this objection. I believe in the *absolute superiority* of certain sounds over others. Sounds that we call musical are not so because we consider them such, but we, being the most cultivated hearers are the best judges of the *fact*. The same fact is in the course of evolution bound to be realized by other animals. In the Santa Lucia Brown Towhee's choice of what is *obviously the most musical sound of the thirteen sounds available for imitative use* I believe we see something not unrelated to *aesthetic taste*.

Let me state my concluding remarks in the form of three points, as follows.

- (1) The CAUSE of bird song evolution is the bird's *aliveness*.
- (2) The METHOD is of necessity *mimicry*, which in itself makes for song-elaboration.
- (3) The RESULT, therefore, is:
 - (a) an improved song;
 - (b) the bird's pleasurable awareness of this fact;
 - (c) the self-stimulation to still further improvement, resulting in a more conscious or deliberate employment of the mimicry METHOD through the exercise of MUSICAL TASTE.

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